CLAIMS

What is claimed is:

1. A transcatheter microwave antenna, comprising:

a microwave transmission line having first and second opposing ends, said first end being adapted for connection to a microwave power source, said microwave transmission line having a center conductor and an outer conductor;

a microwave antenna disposed on said second end of said microwave antenna;

a layer of fusion material disposed radially outward of said microwave antenna, said fusion material being alterable from a first physical state to a second physical state to provide heat of fusion cooling adjacent said catheter during operation of said microwave antenna.

2. The transcatheter microwave antenna of Claim 1, wherein said fusion material is operable for being in a solid physical state prior to operation of said microwave antenna and is operable for melting to a liquid state during operation of said microwave antenna so as to provide cooling radially outward from said catheter.

3. The transcatheter microwave antenna of Claim2, wherein said fusion material in said solid state is substantially flexible.

4. The transcatheter microwave antenna of Claim 1, wherein said fusion material is substantially transparent to microwave radiation so as to absorb little energy directly from said microwave radiation.

5. The transcatheter microwave antenna of Claim 1, wherein said fusion material has a melting point in the range of from approximately eighty to one hundred degrees Fahrenheit.

6. The transcatheter microwave antenna of Claim 1, further comprising:

electrical insulating material between said center conductor and said outer conductor, said microwave antenna being disposed within said electrical insulating material.

7. The transcatheter microwave antenna of Claim 1, further comprising:

an outer sheath surrounding said fusion material.

8. The transcatheter microwave antenna of Claim 1, wherein said layer of fusion material is in surrounding relationship with said microwave antenna.

9. The transcatheter microwave antenna of Claim 1, wherein said fusion material is comprised of a crystalline material.

10. The transcatheter microwave antenna of Claim 1, wherein said fusion material is comprised of a powdered material.

11. The transcatheter microwave antenna of Claim 1, wherein said fusion material is comprised of dibasic sodium phosphate.

12. The transcatheter microwave antenna of Claim 1, wherein said fusion material is comprised of phosphonium chloride.

13. The transcatheter microwave antenna of Claim 1, further comprising:

a tubular conductor to act as an attenuator of microwaves, said tubular conductor being mounted at or near a surface of said catheter and being axially positioned on said catheter adjacent said microwave antenna.

14. The transcatheter microwave antenna of Claim 1, further comprising:

providing material for absorbing microwave heat energy on one side of said microwave antenna so as to make said microwave antenna directional.

15. A method of constructing a transcatheter microwave antenna, further comprising:

providing a cable with one or more conductors;

adapting said cable for connection to a microwave power source;

providing a microwave antenna at one end of said cable;

providing a layer of fusion material adjacent said microwave antenna, said fusion material being alterable to a second physical state from said first physical state to provide heat of fusion cooling adjacent said catheter during operation of said microwave antenna.

16. The method of Claim 14, further comprising:

selecting said fusion material to have a melting temperature in the range from about eighty to one hundred degrees Fahrenheit.

17. The method of Claim 14, further comprising:

selecting said fusion material to be sufficiently flexible for use with a catheter.

18. The method of Claim 14, further comprising:

providing that said fusion material is in surrounding relationship to said microwave antenna.

19. The method of Claim 14, further comprising:

providing that said microwave antenna is directional.

20. The method of Claim 14, further comprising:

providing that said fusion material is a powdered substance when in said first physical state.

21. The method of Claim 14, further comprising:

providing that said fusion material is a crystalline substance when in said first physical state.

22. A method for selective thermal ablation of a tissue to be treated while limiting thermal damage to a protected tissue, comprising:

positioning an energy radiator adjacent to said tissue to be treated such that said protected tissue is between said tissue to be treated and said energy radiator;

positioning a layer of fusion material between said energy radiator and said protected tissue such that convection transfer of energy may occur between said protected tissue and said layer of fusion material;

radiating energy from said energy radiator to heat said tissue to be treated;

limiting temperature rise in said protected tissue by convection transfer of energy

between said protected tissue and said fusion material; and

limiting temperature rise in said fusion material by melting said fusion material from a first physical state to a second physical state due to said convection transfer of energy between said protected tissue and said fusion material.

23. The method of Claim 22, wherein said fusion material has a melting point below body temperature.

24. The method of Claim 22, wherein said fusion material has a melting point in the range of about ninety to one hundred degrees Fahrenheit.

25. The method of Claim 22, wherein said fusion material has a melting point at body temperature.

26. The method of Claim 22, further comprising:

controlling said energy radiator so as to direct energy from said energy radiator in one or more selected directions toward said tissue to be treated.

27. The method of Claim 26, further comprising:

positioning energy absorbing material adjacent said energy radiator to absorb

energy from energy radiator other than energy directed in said one or more selected directions.

28. The method of Claim 22, wherein said fusion material is microwave transparent to limit energy transfer directly from microwaves into said fusion material.

29. The method of Claim 22, further comprising:

selecting a frequency of operation based on a distance of said energy radiator to said tissue to be treated.

30. A method for selective thermal ablation of a tissue to be treated while limiting thermal damage to a protected tissue, comprising:

positioning fusion material adjacent said protected tissue to permit convection transfer of energy between said fusion material and said protected tissue, said fusion material having a melting point near to or lower than body temperature;

radiating energy through said fusion material;

radiating energy through said protected tissue; and

radiating energy into said tissue to be treated.

31. The method of Claim 30, further comprising:

using fusion material that is substantially microwave transparent such that little or no microwave energy is directly absorbed by said fusion material.

32. The method of Claim 30, further comprising:

limiting heat rise in said protected tissue by absorbing heat in said protected tissue into said fusion material as said fusion material melts.

33. The method of Claim 30, further comprising:

attenuating microwaves along the outside of a catheter with a tubular conductor.

34. The method of Claim 30, further comprising:

positioning a catheter in a urethra.

35. The method of Claim 30, further comprising:

positioning a catheter adjacent a prostrate.

36. The method of Claim 30, further comprising:

determining heating time limits based on heat of fusion of said fusion material.

37. The method of Claim 30, further comprising:

using a microwave antenna with radiation points adjusted for depositing energy at a determined distance of said tissue to be treated from said microwave antenna.

38. The method of Claim 30, further comprising:

selecting frequency of operation for depositing energy at a determined distance of said tissue to be treated from said microwave antenna.

39. The method of Claim 30, further comprising:

selectively directing energy from a microwave antenna in one or more directions to deposit energy in said tissue to be treated.

40. A computer program for controlling a simulated microwave antenna for simulated radiation of a biological tissue, comprising:

providing at least one antenna characteristic for said simulated microwave antenna;

providing at least one tissue characteristic into which microwave energy is deposited; and

providing at least one cooling characteristic of cooling substances through which microwaves are transmitted.

41. The computer program of Claim 40, further comprising:

providing a frequency of operation.

42. The computer program of Claim 40, further comprising:

providing a power level.

43. The computer program of Claim 40, further comprising:

providing a delivery time of microwave energy.

44. The computer program of Claim 40, further comprising:

determining a temperature profile within said biological tissue.

45. The computer program of Claim 44, further comprising:

showing temperature versus distance radially outward from said microwave antenna.

46. The computer program of Claim 44, further comprising:

displaying temperature profile changes with time.

47. The computer program of Claim 44, further comprising:

providing a characteristic of absorption material for absorbing said microwave energy in at least one direction.

48. A computer program for controlling a simulated microwave antenna for radiation of a biological tissue, comprising:

providing at least one antenna characteristic for said simulated microwave antenna;

providing at least one tissue characteristic into which microwave energy is deposited;

providing at least one power level for operation of said simulated microwave antenna;

providing at least one frequency of operation of said simulated microwave antenna; and

providing a delivery time of operation of said simulated microwave antenna.

49. The computer program of Claim 48, further comprising:

providing at least one cooling characteristic of cooling substances through which microwaves are transmitted.

50. The computer program of Claim 48, further comprising:

providing a characteristic of absorption material for absorbing said microwave energy in at least one direction.

51. The computer program of Claim 48, further comprising:

determining a temperature profile within said biological tissue.

52. The computer program of Claim 51, further comprising:

showing temperature versus distance radially outward from said simulated microwave antenna.

53. The computer program of Claim 51, further comprising:

displaying said temperature profile changes with time.

54. A computer program for a microwave antenna that radiates a biological tissue, comprising:

providing a desired temperature profile within said biological tissue;

providing at least one tissue characteristic into which microwave energy is deposited; and

providing at least one antenna characteristic.

55. The computer program of Claim 54, further comprising:

providing at least one characteristic of a cooling substance through which microwaves are transmitted.

56. The computer program of Claim 55, further comprising:

providing that said cooling substance is fusion material whereby cooling is produced by heat of fusion.

57. The computer program of Claim 54, further comprising:

determining heating time.

58. The computer program of Claim 54, further comprising:

determining frequency of operation.

59. The computer program of Claim 54, further comprising:

determining a power level.